Resource Management from HPC to the Cloud:

Do you manage resources or do they manage you?

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Award #ACI-1445604

Overview

- View from the border
- IU background
- Jetstream highlights
- Optimizing for your problem
- Reservations & Queueing
- Challenges & Opportunities
- Futures

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View from the Border

- University vs National Center
- Traditional HPC vs Cloud
- Small vs Large Scale
- Lab vs Central Computing
- Working Sessions vs Lunch

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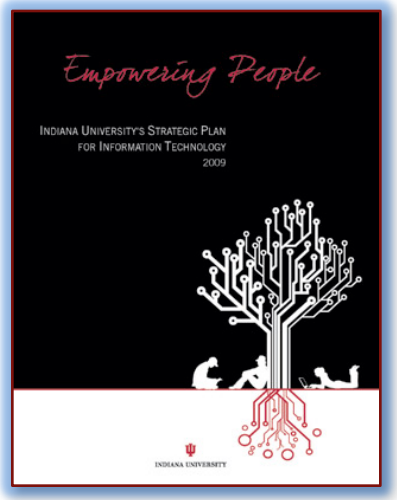
IU – Campuses and Medical School Centers

IU Campuses

IU School of Medicine campuses and clinics

IU goals

- To be one of the great public universities of the 21st Century (Michael A. McRobbie, 18th President of IU)
- To be a leader, "in absolute terms for uses and applications of IT" (Myles Brand, 16th President of IU)



What is Jetstream?

- A resource to *expand the community of users* who benefit from NSF investment in shared cyberinfrastructure
- *Production cloud system* supporting all domains of science and engineering research sponsored by the NSF
- Provide on-demand *interactive* computing and analysis
- Enable *configurable* environments and architectures
- Support computational *reproducibility and sharing*
- Democratizes access to *cloud-native* technology and software
- Focuses on *ease of use*, but also on *maintaining flexibility*

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Expanding NSF XD's reach and impact

Around 350,000 researchers, educators, & learners received NSF support in 2015

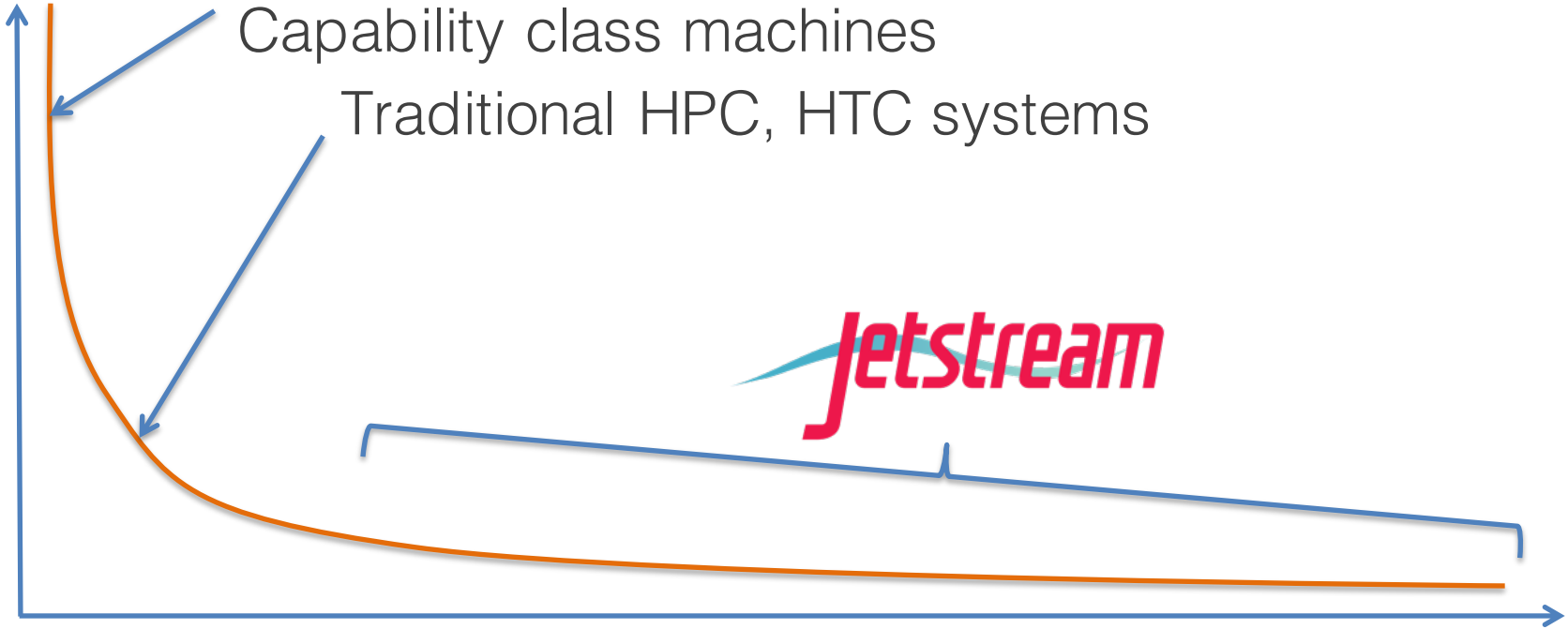
- Less than 2% completed a computation, data analysis, or visualization task on XD program resources
- Less than 4% had an XSEDE Portal account
- 70% of researchers surveyed* claimed to be resource constrained

Why aren't they using XD systems?

- Activation energy is pretty high
- HPC resources are scarce and not well-matched to their needs
- They just don't need *that much* capability

* https://www.xsede.org/xsede-nsf-release-cloud-survey-report

Expanding NSF XD's reach and impact



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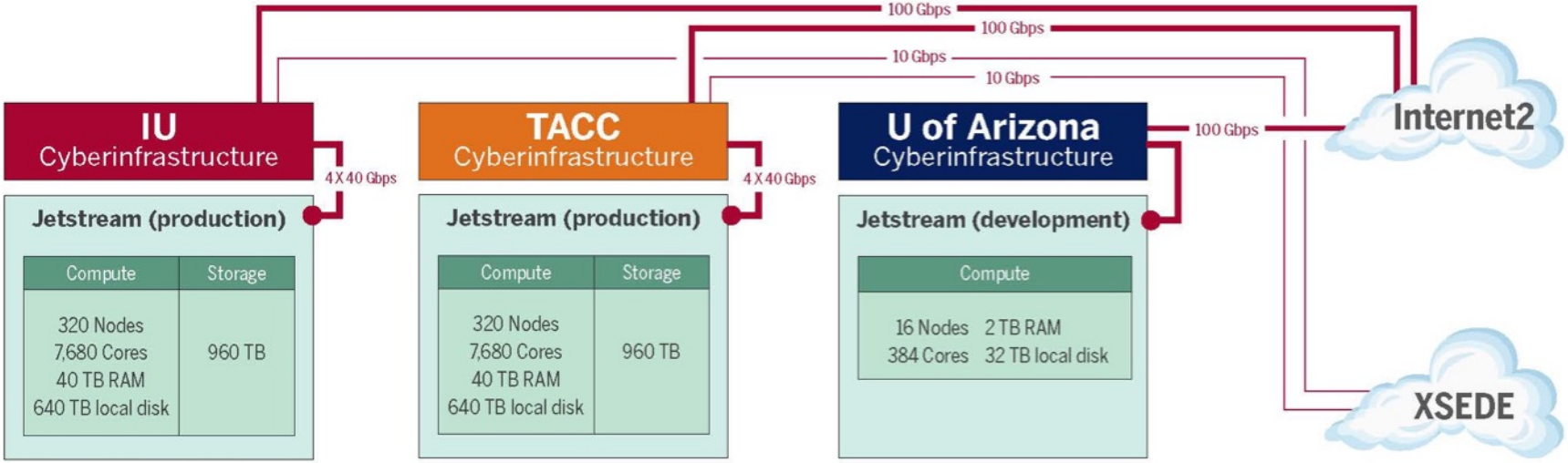
Systems Overview



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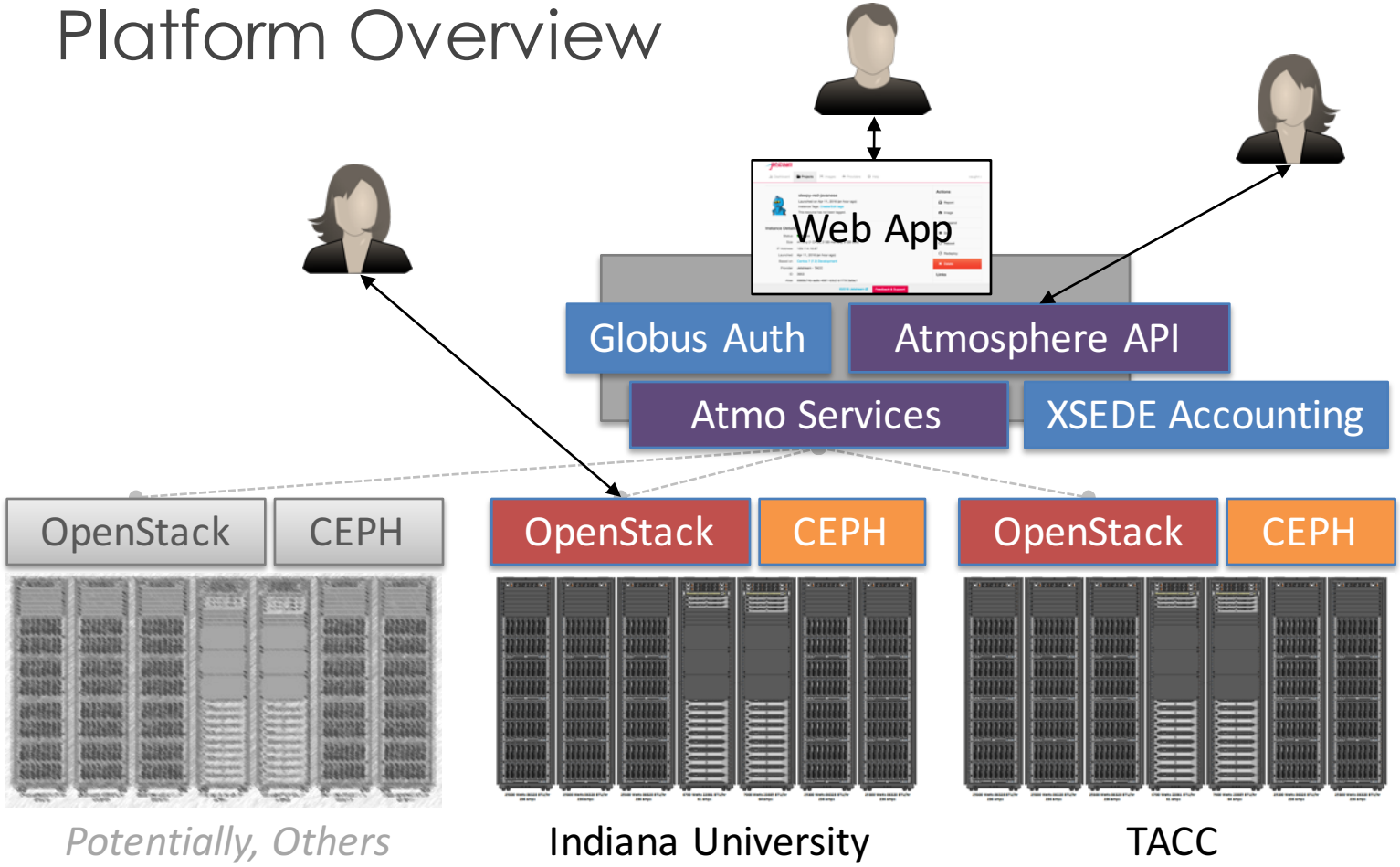
Platform Overview



Atmosphere

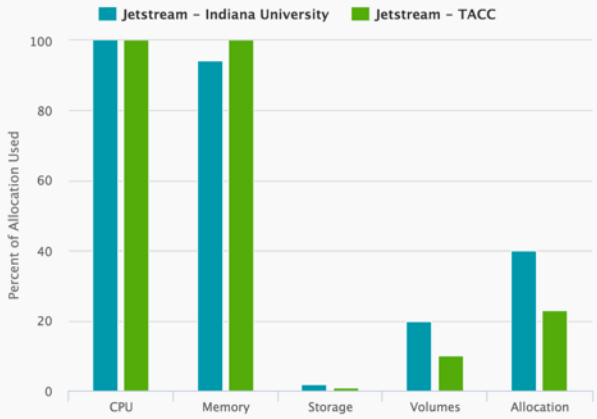
Matthew

https://use.jetstream-cloud.org/application/dashboard

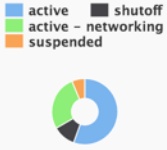
Jetstream | Dashboard | Projects | Images | Providers | Help | vaughn

Resources in Use

Need more?



63 Instances



3 Volumes

Instance History (1458 instances launched)

Updated 15 minutes ago

Launched from Ubuntu 14.04.3 Development GUI
Ran: Apr 11, 2016 06:08 am - Present

0 days ago on Jetstream - TACC

Launched from Ubuntu 14.04.3 Development

0 days ago on Jetstream - TACC

Apr 01, 2016 03:23 pm
CentOS 6 (6.7) Development

jfischer created an image
Mar 31, 2016 10:46 am
CentOS 6 (6.7) Development GUI

admin created an image
Mar 30, 2016 10:08 am
Galaxy 16.01 Standalone

admin created an image
Mar 29, 2016 04:38 pm
Ubuntu 14.04.3 Development

jfischer created an image
Mar 28, 2016 06:26 pm
Ubuntu 14.04.3 Development GUI

jfischer created an image
Mar 18, 2016 04:50 pm
CentOS 7 - GUI

jfischer created an image
Mar 16, 2016 06:07 pm
Centos 7 (7.2) Development

jfischer created an image
Mar 16, 2016 05:26 pm
CentOS 6 (6.7) Development

Feedback & Support

What do you optimize for?

- HPC
  - Utilization
  - Capability or Capacity Science
  - Checkpoint/Restart I/O
  - Memory/Network Bandwidth & Latency
- Cloud
  - Availability
  - Multi-level API Interactions
  - On-demand/Interactive Use
  - Using Commodity Components

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Reservations & Queueing

- HPC
  - Staples of the HPC world with powerful tools (e.g. Moab/Slurm)
  - Decades of expertise and tuning
  - Condo computing "anti-batch"
- Cloud
  - No reservations, no queueing, refocus
    - Some opposition to these concepts
  - Reserved instances "anti-cloud"
  - However… factions in OS community still pushing for do what AWS does

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Opportunities & Challenges

- Opportunities
  - Serving an unmet need with immense & intense interest
  - Affordable HA
  - Satisfying users' visions (SUNY & Galaxy)
- Challenges
  - Need "cloud-washing" for users/staff
    - What, no parallel file system?
  - Logs are verbose and cryptic
  - Rapid development cycle
    - Quickly deprecate functionality
    - Undocumented change
  - Public IPv4 addresses

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What would we change?

- Names of our auth domains
- Clearly separate Atmosphere & Native OS domains
- More storage capacity, a catch-22
- Private IP support from day-1
- Easy-button access from day-1
- Consider host aggregates with restrictions for reservations
- Ubuntu w/lightweight packaging, no RDO
- Mad cluster as default…

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Happy Cluster – Mad Cluster

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What would we do the same?

- Ceph (block/object)
- Use latest OS release (Liberty, testing Mitaka)
- Deliver test cluster early
- Use VXLAN, Intel XL710 adapters (no TSO)
- Dell equipment & F10 switches working well
- Distributed partnership
- Limit site dependencies
- Use SaltStack

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What comes next?

- Both sites have all required software components installed, configured, and operational
- Transitioning to full operations post-acceptance review
- Early June 2016: **57 XSEDE projects and 250+ users**
- Soliciting *Research* allocation requests NOW plus *Startup* and *Education* allocations
- Adding services as deemed useful/mature (heat, ceilometer, magnum, trove, etc)
- Atmosphere enhancements

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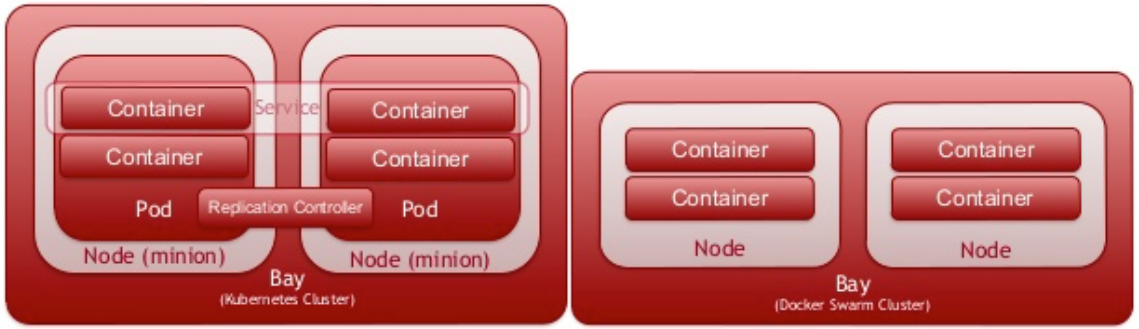
OpenStack Magnum and Container Orchestration Engines

Complete management for containers within OpenStack

Support several container orchestration engines

- Docker Swarm
- Google Kubernetes
- Apache Mesos



Allows direct access to native container APIs

- Docker CLI clients can access hosts and containers
- The Kubernetes client can also directly manage pods, services, etc.

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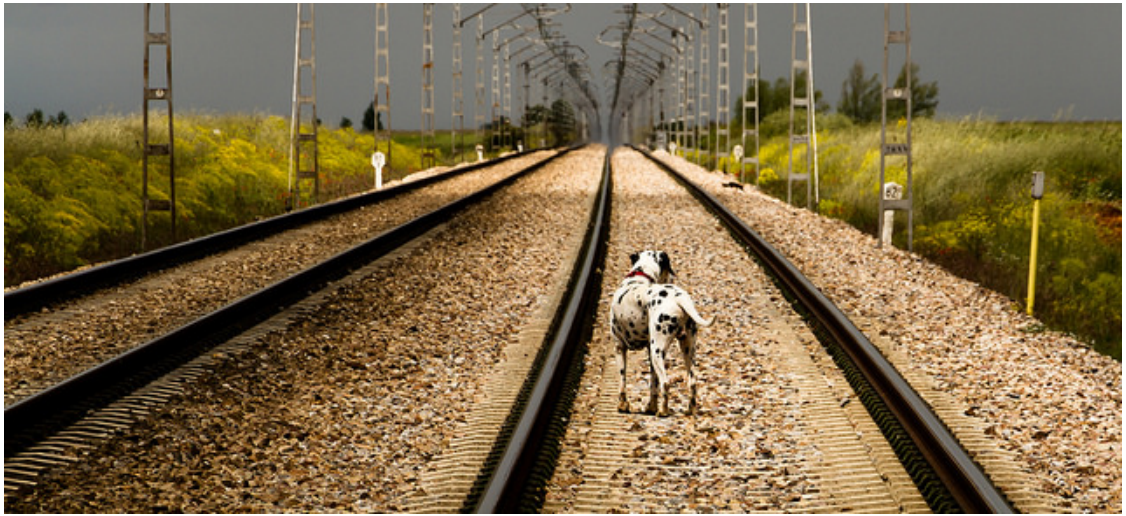
Things I left behind…

- Details on XSEDE/NSF XD Program
- Software block diagram
- Detailed specs
- Detailed topology
- VM sizing
- Security
- State of OpenStack
- Operational tools
- Live Demo



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How can I use Jetstream or learn more?

- An XSEDE User Portal (XUP) account is required. Get one at https://portal.xsede.org
  - Read the Allocations Overview - https://portal.xsede.org/allocations-overview
  - Submit a Startup or Education request - https://portal.xsede.org/successful-requests
- Wiki: http://wiki.jetstream-cloud.org
- User guides: https://portal.xsede.org/user-guides
- Training Videos & Virtual Workshops (TBD)

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Partners

Construction

Management & Operations

Application / Community Leads

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Credit & Thanks

- Mike Lowe, Bret Hammond, George Turner, Jeremy Fischer, Craig Stewart (IU)
- Matt Vaughn, Mike Packard (TACC)
- Paul Rad (UTSA/Rackspace)
- Univ of Arizona CyVerse Team led by Nirav Merchant
- James Taylor (JHU)
- **OS Summit Presentation:** Deploying OpenStack for The National Science Foundation's Newest Supercomputers Lowe, J.M.; Budden, Robert: http://hdl.handle.net/2022/20824
- **SC16 Panel** - Thursday November 17th @3:30 PM
  - HPC/Research Computing leveraging the architectures, flexibilities and tools emerging from the members of the OpenStack Scientific Community

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Questions? help@jetstream-cloud.org

Project website: http://jetstream-cloud.org/

License Terms

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